	FIBER COST							
Cable Size	Cost UG	ost Aeri	nsity=	Density=5-200	Density=200-650	ensity=650-85	ensity=850-255	Density>2550
216	13.10	13.10	13.10	13.10	13.10	13.10	13.10	13.10
144	9.50	9.50	9.50	9.50	9.50	9.50	9.50	9.50
96	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10
72	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90
60	5.30	5.30	5.30	5.30	5.30	5.30	5.30	5.30
48	4.70	4.70	4.70	4.70	4.70	4.70	4.70	4.70
36	4.10	4.10	4.10	4.10	4.10	4.10	4.10	4.10
24	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50
18	3.20	3.20	3.20	3.20	3.20	3.20	3.20	3.20
12	2.90	2.90	2.90	2.90	2.90	2.90	2.90	2.90
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Feeder Cable Size Table

	FEEDER COST							
Cable Size	Cost UG	ost Aeri	nsity=	Density=5-200	Density=200-650	ensity=650-85	ensity=850-255	Density>2550
4,200.00	74.25	74.25	74.25	74.25	74.25	74.25	74.25	74.25
3,600.00	63.75	63.75	63.75	63.75	63.75	63.75	63.75	63.75
3,000.00	53.25	53.25	53.25	53.25	53.25	53.25	53.25	53.25
2,400.00	42.75	42.75	42.75	42.75	42.75	42.75	42.75	42.75
1,800.00	32.25	32.25	32.25	32.25	32.25	32.25	32.25	32.25
1,200.00	21.75	21.75	21.75	21.75	21.75	21.75	21.75	21.75
900.00	16.50	16.50	16.50	16.50	16.50	16.50	16.50	16.50
600.00	11.25	11.25	11.25	11.25	11.25	11.25	11.25	11.25
400.00	7.75	7.75	7.75	7.75	7.75	7.75	7.75	7.75
200.00	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25
100.00	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50

Distribution cable size table

	DISTRIBUTION COST							
Cable Size	Cost UG	ost Aeri	nsity=	Density=5-200	Density=200-650	ensity=650-85	ensity=850-255	Density>2550
3,600	63.75	63.75	63.75	63.75	63.75	63.75	63.75	63.75
3,000	53.25	53.25	53.25	53.25	53.25	53.25	53.25	53.25
2,400	42.75	42.75	42.75	42.75	42.75	42.75	42.75	42.75
1,800	32.25	32.25	32.25	32.25	32.25	32.25	32.25	32.25
1,200	21.75	21.75	21.75	21.75	21.75	21.75	21.75	21.75
900	16.50	16.50	16.50	16.50	16.50	16.50	16.50	16.50
600	11.25	11.25	11.25	11.25	11.25	11.25	11.25	11.25
400	7.75	7.75	7.75	7.75	7.75	7.75	7.75	7.75
200	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25
100	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
50	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63
25	1.19	1.19	1.19	1.19	1.19	1.19	1.19	1.19

Attachment 5B

Hatfield Model Inputs and Assumptions

1. Loop Distribution

1.1 Number of Distribution Cables by Density

DEFINITION
The number of distribution cables assigned to a given CBG, based on the density of the CBG.

DEFAULT VALUES

0-5	2
5-200	4
200-650	4
650-850	4
850-2550	6
>2550	8

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

2. Fill Factors/Utilization

2.1 Distribution Cable Fill Factors

DEFINITION
The spare or excess capacity in a distribution cable, calculated as the ratio of the number of assigned pairs to the total number of available pairs in the cable. An 80% fill factor, for example, implies that 20% of the pairs in the cable provide excess capacity for left-in dial tone, defective pairs and future growth.

DEFAULT VALUES

0-5	.50
5-200	.55
200-650	.60
650-850	.65
850-2550	.70
>2550	.75

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

2.2 Copper Feeder Cable Fill Factors

DEFINITION
The spare or excess capacity in a feeder cable, calculated as the ratio of the number of assigned pairs to the total number of available pairs in the cable. An 80% fill factor, for example, implies that 20% of the pairs in the cable provide excess capacity for left-in dial tone, defective pairs and future growth.

The HM measures fill at the serving area interface (SAI). The HM fill factors reflect fill actually experienced in the cable, as distinguished from fill measured when terminated at the MDF.

DEFAULT VALUES

0-5	.65
5-200	.75
200-650	.80
650-850	.80
850-2550	.80
>2550	.80

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

3. Structure and Structure Fractions

3.1 Distribution Structure Fractions - Overview

DEFINITION
The relative amounts of different structure types supporting distribution cable in each density zone. Aerial distribution cable is attached to telephone poles or buildings, buried cable is laid directly in the earth, and underground cable runs through underground conduit.

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

3.2 Distribution Aerial Fraction

DEFAULT VALUES

0-5	0.5
5-200	0.5
200-650	0.5
650-850	0.5
850-2550	0.4
>2550	0.65

3.3 Distribution Buried Fraction

DEFAULT VALUES

0-5	0.5
5-200	0.5
200-650	0.5
650-850	0.5
850-2550	0.5
>2550	0.05

3.4 Distribution Underground Fraction

DEFAULT VALUES

0-5	0
5-200	0
200-650	0
650-850	0
850-2550	0.1
>2550	0.3

3.5 Copper Feeder Structure Fractions - Overview

DEFINITION

The relative amounts of different structure types supporting copper feeder cable in each density zone. Aerial feeder cable is attached to telephone poles, buried cable is laid directly in the earth, and underground cable runs through underground conduit.

DEFAULT VALUES

0-5	0.5	.45	.05
5-200	0.5	.45	.05
200-650	0.5	.45	.05
650-850	0.4	.40	.20
850-2550	0.1	.10	.80
>2550	0.05	.05	.90

SOURCE

Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

3.6 Copper Feeder Aerial Fraction

DEFAULT VALUES

0-5	0.5
5-200	0.5
200-650	0.5
650-850	0.4
850-2550	0.1
>2550	0.05

3.7 Copper Feeder Buried Fraction

DEFAULT VALUES

0-5	.45
5-200	.45
200-650	.45
650-850	.40
850-2550	.10
>2550	.05

3.8 Copper Feeder Underground Fraction

DEFAULT VALUES

0-5	.05
5-200	.05
200-650	.05
650-850	.20
850-2550	.80
>2550	.90

3.9 Copper Feeder Manhole Spacing, feet

DEFINITION

The distance, in feet, between manholes for copper feeder cable.

DEFAULT VALUE

Density Zone	Distance between manholes, ft.
0-5	800
5-200	800
200-650	800
650-850	800
850-2550	600
>2550	400

SOURCE

AT&T Network Systems, Outside Plant Systems, Network Cable Systems, p. v., 1-13 states that a ductic cable 4200-pair standard 420 reel holds 810 feet of 4200-pair cable, supporting the 800 ft. default spacing.

National Construction Estimator, 1996.

3.10 Copper Structure Pole Spacing, feet

DEFINITION

Spacing between poles supporting aerial copper feeder cable

DEFAULT VALUE

150 feet

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

3.11 Copper Feeder Buried Cable Armoring Multiplier

DEFINITION
The additional cost of the filling compound used in buried cable to protect the cable from moisture, expressed as a multiplier of the cost of non-armored cable.

DEFAULT VALUE
1.1

SOURCE
AT&T Network Systems, Outside Plant Systems, Network Cable Systems, pp. v, 1-13.

3.12 Fiber Feeder Structure Fractions - Overview

DEFINITION
The relative amount of different structure types supporting fiber feeder cable in each density zone. Aerial cable is attached to telephone poles, buried cable is laid directly in the earth, and underground cable runs through underground conduit.

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

3.13 Fiber Feeder Aerial Fraction

DEFAULT VALUES

0-5	0.35
5-200	0.35
200-650	0.35
650-850	0.20
850-2550	0.10
>2550	0.05

3.14 Fiber Feeder Buried Fraction

DEFAULT VALUES

0-5	.60
5-200	.60
200-650	.60
650-850	.60
850-2550	.10
>2550	.05

3.15 Fiber Feeder Underground Fraction

DEFAULT VALUES

0-5	.05
5-200	.05
200-650	.05
650-850	.20
850-2550	.80
>2550	.90

3.16 Fiber Feeder Manhole Spacing, feet

DEFINITION
The distance, in feet, between manholes for fiber feeder cable.

DEFAULT VALUE

Density Zone	Distance between manholes, ft.
0-5	2,000
5-200	2,000
200-650	2,000
650-850	2,000
850-2550	2,000
>2550	2,000

SOURCE
Cable Construction Manual, 4th Edition p. 75, CommScope.

3.17 Fiber Feeder Buried Cable Armoring, per foot

DEFINITION
The cost of dual sheathing for additional mechanical protection of fiber feeder cable.

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

DEFAULT VALUE
$0.20/foot

3.18 Fiber Structure Pole Spacing, feet

DEFINITION
Spacing between poles supporting aerial fiber feeder cable

DEFAULT VALUE
150 feet

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

3.19 Fiber feeder distance threshold, feet

DEFINITION
The feeder length above which fiber feeder cable is used in lieu of copper cable.

DEFAULT VALUE
9,000 ft.

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

Sensitivity runs on many states have indicated a cost curve minimization point at approximately 9,000 ft. (keeping other HM variables constant).

4. Structure Factors

4.1 Distribution Structure % Assigned to Telephone

DEFINITION
The fraction of distribution structure assigned to LECs. Because LECs should increasingly employ joint trenching operations with gas, electric and water companies, investment in structures such as telephone poles and trenches will be shared with other utilities and cable operators.

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

DEFAULT VALUES

aerial	0.33
buried	0.33
underground	0.33

4.2 Feeder Structure % Assigned to Telephone

DEFINITION
The fraction of feeder structure investment assigned to LECs, Because LECs should increasingly employ joint trenching operations with gas, electric and water companies, investment in structures such as telephone poles and trenches will be shared with other utilities and cable operators.

DEFAULT VALUE

aerial	0.33
buried	0.33
underground	0.33

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

5. Outside Plant Material and Labor Costs

Distribution Costs

5.1 Copper Distribution Cable, $/foot

DEFINITION

The cost per foot of copper distribution cable. The costs outlined below vary by cable size and include the costs of engineering, installation, and delivery, as well as the cable material itself.

DEFAULT VALUES

3600	$63.75
3000	$53.25
2400	$42.75
1800	$32.25
1200	$21.75
900	$16.50
600	$11.25
400	$7.75
200	$4.25
100	$2.50
50	$1.63
25	$1.19

SOURCE

Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

5.2 Distribution Structure Buried Installation Cost/Foot

DEFINITION

The additional cost per foot to bury distribution cable, including materials and labor.

DEFAULT VALUES

0-5	$2.00
5-200	$2.00
200-650	$2.00
650-850	$3.00
850-2550	$3.00
>2550	$20.00

SOURCE

Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

5.3 Distribution Structure Conduit Installation Cost/Foot

DEFINITION

The additional cost per foot of placing copper distribution cable in underground conduit, including trenching.

DEFAULT VALUES

0-5	$25.00
5-200	$25.00
200-650	$25.00
650-850	$25.00
850-2550	$45.00
>2550	$75.00

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

NID Costs

5.4 NID Investment per line

DEFINITION
The investment in the network interface device (NID), the device at the customers' premises within which the drop wire terminate, and which is the point of subscriber demarcation.

DEFAULT VALUES

HM 2.2.2	Costs
NID Materials	$15.00
Labor costs	$15.00

SOURCES
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts., as well as quotes from industry subcontractors and suppliers.

A major NID supplier at SuperCom 96, the industry's largest trade show, in Dallas, Texas supported the $12 - $16 range for the NID case.

Drop Costs

5.5 Drop Investment per line

DEFINITION
The cost per line for drop wire connecting the customer premises to the terminal at the distribution cable.

DEFAULT VALUE
$40

SOURCES
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

1993 New England Incremental Cost Study, provided to the New Hampshire Public Utilities Commission (NHPUC) order number 20,082, Docket 89-010/85-182, issued March 11, 1991.

5.6 Terminal and Splice Investment per line

DEFINITION
The installed cost per line for the terminal and splice that connect the drop to the distribution cable.

DEFAULT VALUE
$35/house or per line

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts., as well as quotes from industry subcontractors and suppliers.

Copper Feeder Costs

5.7 Copper Feeder Cable, $/ foot

DEFINITION
The cost per foot of copper feeder cable. The costs outlined below vary by cable size and include the costs of engineering, installation, and delivery, as well as the cable material itself.

DEFAULT VALUE

4200	$74.25
3600	$63.75
3000	$53.25
2400	$42.75
1800	$32.25
1200	$21.75
900	$16.50
600	$11.25
400	$7.75
200	$4.25
100	$2.50

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

5.8 Copper Feeder Buried Installation Cost/Foot

DEFINITION
The additional cost to bury copper feeder cable, including materials and labor.

DEFAULT VALUE

0-5	$2.00
5-200	$2.00
200-650	$3.00
650-850	$3.00
850-2550	$3.00
>2550	$25.00

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

5.9 Copper Feeder Pole Investment

DEFINITION
The installed cost of a 35' Class 4, treated southern pine pole.

DEFAULT VALUE
$450

SOURCES
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts. The cost is split approximately 40/60 material ($180) to labor ($270) and assumes installation by high production machinery such as power auger trucks, as part of a full day of new pole placements.

5.10 Copper Feeder Conduit Installation Cost/Foot

DEFINITION
The additional cost per foot of placing copper feeder cable in underground conduit including trenching.

DEFAULT VALUES

0-5	$25.00
5-200	$25.00
200-650	$25.00
650-850	$25.00
850-2550	$45.00
>2550	$75.00

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

5.11 Conduit Material Investment per foot

DEFINITION
Material cost per foot of duct for 4" PVC.

DEFAULT VALUE
$1.00

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

5.12 Manhole Investment, materials and labor

DEFINITION
The installed cost of a prefabricated concrete manhole.

DEFAULT VALUE
$3,000

SOURCES
1996 National Construction Estimator, 44th Edition, by Martin Kiley (pg. 442) lists a precast concrete power manhole (dimensions 4' x 6' x 7') at $1,930 for materials and $888 for labor.

5.13 Pole materials and labor

DEFINITION
The installed cost of a 35' Class 4, treated southern pine pole.

SOURCES
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts. The cost is split approximately 40/60 material ($180) to labor ($270) and assumes installation by high production machinery such as power auger trucks, as part of a full day of new pole placements, not replacements.

DEFAULT
$450

Fiber Feeder Costs

5.14 Fiber Feeder Cable, $/foot

DEFINITION
The cost per foot of fiber feeder cable. The costs outlined below vary by cable size and include the costs of engineering, installation, and delivery, as well as the cable material itself.

DEFAULT VALUE

216	$13.10
144	$9.50
96	$7.10
72	$5.90
60	$5.30
48	$4.70
36	$4.10
24	$3.50
18	$3.20
12	$2.90

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

5.15 Fiber Feeder Buried Installation, per foot

DEFINITION
The additional cost per foot to bury fiber feeder cable.

DEFAULT VALUES

0-5	$2.00
5-200	$2.00
200-650	$2.00
650-850	$3.00
850-2550	$3.00
>2550	$20.00

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

1996 National Construction Estimator, 44th Edition, by Martin Kiley.

5.16 Fiber Feeder Conduit Installation, per foot

DEFINITION
The additional cost per foot of placing fiber feeder cable in underground conduit including trenching.

DEFAULT VALUES

0-5	$25.00
5-200	$25.00
200-650	$25.00
650-850	$25.00
850-2550	$45.00
>2550	$70.00

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

5.17 SAI Investment, installed (copper)

DEFINITION
The installed cost of a serving area interface (SAI) for copper feeder, including mounting the SAI on a pole or pad (depending on the number of distribution pairs terminated in the SAI), and connecting the feeder and distribution cables to the terminal blocks contained in the SAI.

DEFAULT VALUES

0	$500
100	$700
200	$900
400	$1100
600	$1300
900	$1500
1200	$1700
1800	$1900
2400	$2100
3000	$2300
3600	$2500

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

5.18 SAI Investment, installed (fiber)

DEFINITION
The installed cost of a serving area interface (SAI) for fiber feeder. The fiber SAI is collocated with the digital loop carrier remote terminal, and includes the optical patch panel on the feeder side of the remote terminal, a copper pair cross connect on the distribution side of the remote terminal, the associated enclosure, and either pole or ground mounting, depending on the number of distribution pairs terminated in the SAI.

DEFAULT VALUES

0	$2500
100	$2700
200	$2900
400	$3100
600	$3300
900	$3500
1200	$3700
1800	$3900
2400	$4100
3000	$4300
3600	$4500

SOURCES
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

5.19 SLC (TR-303) site, housing, and power per remote terminal

DEFINITION
The investment associated with site, housing and power for the remote terminal of a Subscriber Loop Carrier (SLC) system serving a large number of subscribers and configured for TR-303. The $3,000 per remote terminal includes a concrete slab, wiring and power for the RT. The housing investment is included in the common equipment total. The default value is intended to include the amount for common equipment associated with establishing 672 line bays in the remote terminal.

DEFAULT VALUE
$3,000

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

5.20 SLC common equipment investment

DEFINITION
The cost of all common equipment and housing in the remote terminal, as well as the fiber optics multiplexer required at the CO end of the SLC system.

The default value provides for a fiber optic multiplexer, sized for OC-3, or 155Mb/s, which can support a maximum of 84 DS-1s that can serve 2,016 POTS lines on 4 fibers

DEFAULT VALUE
$42,000

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

5.21 SLC channel unit investment per line

DEFINITION
The per line investment in channel units required in the remote terminal of the SLC system.

DEFAULT VALUE
$75

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

5.22 AFC site, housing, and power per remote terminal

DEFINITION
The investment associated with site, housing and power for the remote terminal of an AFC system. The $2,500 per remote terminal includes a concrete slab, wiring and power for the RT. The housing investment is included in the common equipment total. The default value is intended to include the amount for common equipment associated with establishing 100 line bays in the remote terminal.

DEFAULT VALUE
$2,500

SOURCE
Based on publicly available pricing and specifications from Advanced Fiber Communications (AFC).

5.23 AFC common equipment investment

DEFINITION
This cost includes all common equipment and housing in the remote terminal, and the fiber optics multiplexer required at the CO end of the AFC system.

DEFAULT VALUE
$10,000

SOURCE
Based on publicly available pricing and specifications from AFC.

5.24 AFC channel unit investment per line

DEFINITION
The investment per line in channel units required in the remote terminal of the AFC system.

DEFAULT VALUE
$150

SOURCE
Based on publicly available pricing and specifications from AFC.

6. Miscellaneous Loop Inputs

6.1 Average Lines per Business Location

DEFINITION
The assumed average number of business lines per business location, used to determine the number of businesses, and thus the number of terminal and NIDs, given the number of business lines served by the LEC being studied.

DEFAULT VALUE
4

SOURCE
HAI estimated the default based on review of statistical abstracts and represents an average of large, medium and small business.

6.2 Feeder Structure Fraction Shared with Interoffice

DEFINITION
The percentage of feeder structure that is also shared by interoffice transport facilities.

DEFAULT VALUE
.25

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

SLC Inputs

6.3 SLC remote terminal fill factor

DEFINITION
The line unit fill factor in a SLC remote terminal. That is, the ratio of lines served by a SLC remote terminal to the number of line units equipped in the remote terminal.

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

DEFAULT VALUE
0.90

6.4 SLC fibers per remote terminal

DEFINITION
The number of fibers connected to each SLC remote terminal, including one for upstream transmission, one for downstream transmission, and two or more spares.

DEFAULT VALUE
4

SOURCE
Assumption based on industry common knowledge.

6.5 SLC Maximum Lines

DEFINITION
The maximum number of lines supported by a single SLC remote terminal. 672 is the equivalent of a DS-3 capacity.

DEFAULT VALUE
672

SOURCE
Assumption based on common industry knowledge.

6.6 SLC DS-0s per fiber

DEFINITION
The number of voice equivalent circuits that can, through multiplexing, be transmitted on a single pair of fibers in a SLC system.

DEFAULT VALUE
2,016 nominal voice circuits

SOURCE
Assumption based on common industry knowledge.

AFC Inputs

6.7 AFC remote terminal fill factor

DEFINITION
The line unit fill factor in an AFC remote terminal. That is, the ratio of lines served by an AFC remote terminal to the number of line units equipped in the remote terminal.

DEFAULT VALUE
0.90

SOURCE
Based on publicly available pricing and specifications from AFC.

6.8 AFC fibers per remote terminal

DEFINITION
The number of fibers connected to each remote terminal, including one for upstream transmissions, one for downstream transmissions, and two or more spares for backup. The number of fibers provisioned by the HM is the number of remote terminals, multiplied by the AFC fibers per remote terminal default.

DEFAULT VALUE
4

SOURCE
Based on publicly available pricing and specifications from AFC.

6.9 AFC maximum lines

DEFINITION
The number of lines, or customer premise connections, run out of a single terminal.

DEFAULT VALUE
100

SOURCE
Based on publicly available pricing and specifications from AFC.

6.10 AFC DS-0s per fiber

DEFINITION
The number of simultaneous conversations that can, through multiplexing, be transmitted on a single fiber cable.

DEFAULT VALUE
2,016

SOURCE
Based on publicly available pricing and specifications from AFC.

7. Wire Center

7.1 Lot size

DEFINITION
The multiplier of switch room size to arrive at total lot size, assuming that land area is needed to accommodate

DEFAULT VALUE
2

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

7.2 Tandem/EO wire center common factor

DEFINITION
The percentage of tandem switches which are also end office switches or are collocated in wire centers with end office switches. This accounts for the fact that tandems and end offices are often located together, and is employed to avoid double counting of land and other wire center investment in these instances.

DEFAULT VALUE
0.4

SOURCE
Analysis based on Bellcore LERG data.

7.3 Power and frame investment

DEFINITION
The wire center investment required for rectifiers, battery strings, back-up generators and various distributing frames, as a function of switch line size.

DEFAULT VALUE

0	$10,000
1000	$20,000
5000	$40,000
25,000	$100,000
50,000	$500,000

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

7.4 Switch room size

DEFINITION
The area in square feet required to house a switch and its related equipment.

DEFAULT VALUE

0	500
1,000	1,000
5,000	2,000
25,000	5,000
50,000	10,000

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

7.5 Construction costs, per sq. ft.

DEFINITION
The costs of construction of a wire center building. The cost of equipment in the wire center is taken into account in other inputs.

DEFAULT VALUE

0	$75
1,000	$85
5,000	$100
25,000	$125
50,000	$150

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI outside plant engineering experts.

7.6 Land price, per sq. ft.

DEFINITION
The land price associated with a wire center. The price per square foot is assumed to increase with the number of lines served to account for higher prices typically associated with greater population densities.

DEFAULT VALUE

0	$5.00
1,000	$7.50
5,000	$10.00
25,000	$15.00
50,000	$20.00

8. End Office Switching

8.1 Busy hour call attempts, residential

DEFINITION
The number of call attempts originated by residential subscribers during the busy hour. A call attempt is defined as going off hook, receiving dial tone and dialing at least one digit. Attempts include not only completed calls, but partial dials, abandoned calls and calls reaching busy or no answer. Calls are measured in the "busy hour", which for central office engineering is time consistent busy hour. Time consistent busy hour methodology for measuring call attempts is the busiest fixed hour in each day of the average busy season. The average busy season is the three highest months in the year, not necessarily consecutive. The busy season excludes extremely high peaked days due to holidays or environmental factors such as severe weather.

DEFAULT VALUE
1.3

SOURCE
Bell Communications Research, *LATA Switching Systems Requirements*, Section 17: Traffic Capacity and Environment, TR-TSY-000517, Issue 3, March 1989.

8.2 Busy hour call attempts, business

DEFINITION
The number of call attempts originated by business subscribers. A call attempt is defined as going off hook, receiving dial tone and dialing at least one digit. Attempts include not only completed calls, but partial dials, abandoned calls and calls reaching busy or no answer. Calls are measured in the "busy hour", which for central office engineering is time consistent busy hour. Time consistent busy hour methodology for measuring call attempts is the busiest fixed hour in each day of the average busy season. The average busy season is the three highest months in the year, not necessarily consecutive. The busy season excludes extremely high peaked days due to holidays or environmental factors such as severe weather.

DEFAULT VALUE
3.5

SOURCE
Bell Communications Research, *LATA Switching Systems Requirements*, Section 17: Traffic Capacity and Environment, TR-TSY-000517, Issue 3, March 1989.

Switch Variables

8.3 Switch maximum line size

DEFINITION
The maximum number of lines that a typical digital switching machine can support.

DEFAULT VALUE
100,000

SOURCE
Assumption based on industry common knowledge.

8.4 Switch maximum line fill

DEFINITION
The fraction of the maximum line size an end office can utilize before the model will add another switch. For instance, for a maximum line size of 100,000 and a maximum line fill of .80, the model will add another switch when demand exceeds 80,000 lines.

DEFAULT VALUE
0.80

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI switching experts.

8.5 Switch installation multiplier

DEFINITION
The telephone company investment in switch engineering and installation activities, expressed as a multiplier of the switch investment.

DEFAULT VALUE
1.10

SOURCE
The 10% factor used in the Hatfield model was derived based on the following information. Bell Atlantic ONA filing (FCC Docket 92-91) on February 13, 1992, showed a range of engineering factors for the different Bell Atlantic states between .08 and .108. The SBC ONA filing (FCC Docket 92-91) on May 18, 1992, showed a range of engineering and plant labor factors added together between .0879 and .1288. The 10% incremental-based factor is a conservative estimate, given the ranges filed by two RBOCs using traditional ARMIS-based embedded cost factor development.

8.6 Switch maximum processor occupancy

DEFINITION
The fraction of total capacity (measured in busy hour call attempts, BHCA) an end office switch is allowed to carry before the model adds another switch.

DEFAULT VALUE
0.90

SOURCE
This is a universally accepted figure, based on industry common knowledge.

8.7 Processor feature loading multiplier

DEFINITION
The amount by which the load on a switch exceeds the load associated with ordinary telephone calls, due to the presence of vertical features such as Centrex, 3-way calling, etc., expressed as a multiplier of nominal load. Therefore, at a volume of 1.0, the load is given by BHCA.

DEFAULT VALUE
1.00

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI switching experts.

8.8 Switch real-time limit, busy hour call attempts

DEFINITION
The maximum number of busy hour call attempts (BHCA) a switch can handle. If the model determines that the load on a switch, calculated as the number of busy hour call attempts times the processor feature load multiplier, would exceed the switch real time limit multiplied by the switch maximum processor occupancy, it will require the addition of another switch.

Calls are measured in the "busy hour", which for central office engineering is time consistent busy hour. Time consistent busy hour methodology for measuring call attempts is the busiest fixed hour in each day of the average busy season. The average busy season is the three highest (call volume) months in the year, which are not necessarily consecutive. The busy season excludes extremely high peaked days due to holidays or environmental factors such as natural disasters.

Switch manufacturers rate the call processing capabilities in terms of busy hour call attempts (BHCA). A call attempt is defined as going off hook, receiving dial tone and dialing at least one digit. Thus, call attempts include not only completed calls, but partial dials, abandoned calls and calls reaching busy or no answer. Alternatively, a manufacturer may also rate the call processing in terms of completed calls in the busy hour.

DEFAULT VALUES

1-1,000	10,000
1,000-10,000	50,000
10,000-40,000	200,000
40,000+	600,000

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI switching experts.

8.9 Switch traffic limit, BHCCS

DEFINITION
The maximum amount of traffic, measured in hundreds of call seconds (CCS) the switch can carry in the busy hour (BH).

DEFAULT VALUE

1-1,000	10,000
1,000-10,000	50,000
10,000-40,000	500,000
40,000+	1,000,000

8.10 Switch cost points

DEFINITION
The three switch line sizes, and associated switching cost per line, that define the switch investment function in the HM. After the Hatfield model determines the required end-office switch line size, it obtains the investment per line from the investment function that relates per-line switching investment to switch line size. The model uses the investment per line and end-office switch line size to develop total end-office investment.

DEFAULT VALUES

	Lines	Cost/line
low line size	2,782	$220.00
mid line size	11,200	$86.00
high line size	80,000	$59.00

SOURCE
Northern Business Information study: U.S. Central Office Equipment Market -- 1995, McGraw-Hill

These defaults are three points on a cost curve. Therefore, any point along the curve becomes a possible default value.

Traffic Variables

8.11 Residential holding time multiplier

DEFINITION
The modified average residential call "holding time" (i.e., duration) due to Internet use or other causes, expressed as a multiplier of the holding time associated with ordinary telephone calls.

DEFAULT VALUE
1.00

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI switching experts.

8.12 Business holding time multiplier

DEFINITION
The modified average business call "holding time" (i.e., duration) due to Internet use or other causes, expressed as a multiplier of the holding time associated with ordinary telephone calls.

DEFAULT VALUE
1.00

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI switching experts.

8.13 Busy hour fraction of daily usage

DEFINITION
The percentage of daily usage that occurs during the busy hour.

DEFAULT VALUE
0.10

SOURCE
This is an standard industry average.

8.14 Annual to daily usage reduction factor

DEFINITION
The effective number of business days in a year, used to concentrate annual usage into a fewer number of days as a step in determining busy hour usage.

DEFAULT VALUE
270

SOURCE
This is at the high end of an industry average range between 250 and 270.

9. Interoffice and Tandem Parameters

9.1 Operator traffic fraction

DEFINITION
Percentage of all calls that require operator assistance. This assistance can be automated or manual (see Operator intervention fraction below)

DEFAULT
0.02

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI traffic engineering experts.

9.2 Total interoffice traffic fraction

DEFINITION
The fraction of all calls that are completed on a switch other than the originating switch, as opposed to calls completed within a single switch.

DEFAULT
0.65

SOURCE
Industry experience and expertise of Hatfield Associates and AT&T/MCI traffic engineering experts.

9.3 Direct-routed fraction of local inter-office

DEFINITION
The amount of local interoffice traffic that is directly routed between originating and terminating end offices as opposed to being routed via a tandem switch.

DEFAULT
0.98